output, hypoperfusion) may very well have occurred or been exacerbated intraoperatively. It may be that observational studies with additional intraoperative data elements may be as effective in enhancing our knowledge base about the relationship between temperature and outcomes in patients undergoing coronary artery bypass surgery.

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doi:10.1016/j.jtcvs.2010.08.051

SPONTANEOUS RUPTURE OF THE DIAPHRAGM: A DIAGNOSTIC ENIGMA

To the Editor:

We read with great interest the recent article by Losanoff and colleagues[1] on spontaneous rupture of the diaphragm (SRD), a rare condition accounting for less than 1% of diaphragmatic ruptures.[2] Delayed or inaccurate diagnosis remains its most challenging feature with a number of reports of inadvertent perforation of the stomach or bowel from tube thoracostomy after its wrongful interpretation on chest radiograph as pneumothorax or pleural effusion.

The difficulty in achieving early, accurate diagnosis is partly due to the sometimes innocuous cause of SRD and the nonspecific symptoms and signs associated with its occurrence. In addition, there is often a symptom-free interval between the precipitating events and the presenting symptoms, thus further complicating the diagnosis. Coughing, vaginal delivery, vomiting, massage, and dynamic physical exercise are recognized etiologic factors. Static sporting activity (Pilates) has also recently been reported as a cause of SRD.[3]

Plain chest radiograph and in some cases routine computed tomography (CT) scans are easily misinterpreted, as was the case in a child who presented with SRD after pertusis.[4] A barium meal gives the diagnosis, but this investigation is often only resorted to once there is a high index of suspicion and in addition provides limited information to aid treatment. Contrast-enhanced coronal multiplanar reformatted images of multidetector CT scans has been shown to be an optimum diagnostic tool.[5] This modality facilitates detection of the typical collar sign between the body of the stomach in the abdominal cavity and the herniated gastric fundus. Furthermore, by identifying the degree of enhancement in the herniated bowel, a decision on the operative approach to management can be made. The intraabdominal approach is chosen as the optimal operative method for rupture of the diaphragm where the contrast-enhanced chest CT scan shows poor enhancement of the herniated gastric fundus. This finding is suggestive of the presence of strangulation in the herniated bowel. Choosing a transthoracic approach in such a case may not provide the surgeon with a wide enough operative field for the resection of strangulated bowel.

Admittedly, multiplanar reformatted images are not performed on routine CT scans, but when a high index of suspicion of diaphragmatic rupture is attained on the basis of history or chest radiography, then this modality should be used.

The key message though is that SRD remains a real and potentially life-threatening condition if missed or misdiagnosed. It should thus be paramount in the mind of any clinician reviewing a patient who has epigastric pain or dyspnea after an apparently innocuous Valsalva maneuver or contemplating tube thoracostomy in a questionable pneumothorax or pleural effusion.

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doi:10.1016/j.jtcvs.2010.08.049

Reply to the Editor:

We appreciate the comments expressed by Drs Bello and Sarkar regarding our recently published review article on spontaneous rupture of the diaphragm (SDR).[1] Challenges of this topic include the extreme rarity of the condition, preponderance of literature based on case reports, and low index of suspicion.

We partially agree with Bello and Sarkar that plain chest radiograph can easily be misinterpreted as pneumothorax that requires tube thoracostomy; hollow organ injury has so far been described twice (7%) in this rare clinical scenario.[2,3] It must be noted, however, that in the majority

of SDR reports, plain chest radiography was the mainstay in diagnosis of the hernia, followed by verification with contrast studies.[1] Bello and Sarkar correctly note that contrast-enhanced coronal multiplanar reformatted images of multidetector computed tomography aid the diagnosis of SDR, although the contention is based on a single case report.[4] A recently published trial explored the method's diagnostic value in patients with known traumatic diaphragmatic hernias and found that distinct radiologic signs of hernia were present in 33% to 58% of the patients, suggesting that obtaining sagittal and coronal images can improve the diagnosis.[5] Considering that in the SDR group 33% of the hernias contained 2 organs and 25% contained 3 organs,[1] one can imagine the importance of preoperative delineation of the anatomy.

Bello and Sarkar should be commended for reinforcing that, whenever the chest radiograph is equivocal or suspicious for SDR, computed tomography supplemented by multiplanar reformation obtained using thin-slice axial scanning and overlapping images for reformations must be performed. This can help to plan the surgical intervention and improve the outcome of this life-threatening surgical emergency.

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doi:10.1016/j.jtcvs.2010.08.050

SIMPLIFYING ROBOTIC MITRAL VALVE REPAIR: MINIMIZING SUTURES WITH INTRA-ANNULAR RING IMPLANTATION

To the Editor:

We read with great interest the article on running annuloplasty suture technique for robotically assisted mitral valve repair by Mihaljevic and colleagues.[1] We congratulate them on their innovative approach to simplifying ring annuloplasty for robotic valve repair; they report impressive numbers and excellent results.

Dedicated surgical instruments have been developed for minimally invasive and robotic cardiac surgery. Annuloplasty rings and bands have not been adapted to these approaches, however, and, as mentioned by Mihaljevic and colleagues,[1] still require multiple suture placement and knot tying, which are somewhat difficult, tedious, and time-consuming in robotic valve repair. The multiple suture placement required for ring or band implantation has been facilitated with the use of nitinol U clips (Coalescent Inc, Sunnyvale, Calif), as shown in an animal model.[2] In a retrospective review of their clinical experience, however, Cook and associates failed to demonstrate a significant difference in the time to place a U clip versus a suture after controlling for the robotic-assisted suture tying learning curve.[3]

The technique proposed by Mihaljevic and colleagues[1] of using a running suture for annuloplasty is an elegant method of reducing the complexity of mitral valve annuloplasty. Devices optimized for minimally invasive cardiac surgery, minimizing sutures or U clip use, could offer another option to reduce the complexity and duration of ring implantation. We previously reported our initial experience in using the Bioring Kalangos (Bioring SA, Lonay, Switzerland) biodegradable annuloplasty ring for video-assisted thoracoscopic and robotic-assisted tricuspid valve repairs in 10 patients.[4] This device, available both for mitral and tricuspid annuloplasty, is inserted directly into the native tricuspid annulus, with the suture extensions at each extremity of the ring sewn in 2 to 3 bites.[5] This has the advantage that no further sutures are required, thus possibly simplifying implantation in robotic surgery.

This ring was designed for traditional valve repair; however, it appears particularly well adapted to minimally invasive valve surgery. It was easily implanted without a significant learning curve. This device, which achieved CE marking in 2005, is being evaluated by the Food and Drug Administration but is not currently approved beyond exceptional compassionate use exemptions. Furthermore, long-term follow-up is still lacking.

We congratulate Mihaljevic and colleagues[1] on their innovative and thoughtful approach to a simplifying robotic mitral repair by using proven annuloplasty devices. We humbly suggest that using devices optimized for the specifics of robotic valve repair, minimizing suture or U clip requirements, could further simplify these procedures and improve outcomes.

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